

To: Vann, Bradley[Vann.Bradley@epa.gov]
From: Hooper, Charles A.
Sent: Wed 5/20/2015 8:55:59 PM
Subject: RE: Recent CAG question
[rad COCs.png](#)
[rad COCs 2.png](#)

Brad,

Just for my own curiosity I went back and looked at the radionuclides that EMSI is testing for and compared it the Radionuclides listed in the 2011 SFS, (which actually refers to the BRA) (see attached). I think we can justifiably assume, without any new compelling evidence to the contrary, that any radioactive material associated with Mallinkrodt or SLAPs was from uranium ore processing and would thus be parents or daughters of the three main naturally occurring decay chains: uranium decay chain (with U238), actinium decay chain (with U235), and the thorium decay chain (with Th232).

#7 of the EMSI Phase 1D work plan addendum states:

Upon arrival at the radiological laboratory, the samples will be dried and ground to promote homogeneity and analyzed for Radium-226,; Radium-228; Thorium-230 and Thorium-232; Uranium-234, Uranium-235 and Uranium-238; Actinium-227; Potassium-40; Protactinium-231; Scandium; and Lead-210. The samples will also be analyzed for TAL trace metals, plus Sulfate, Carbonate, and Fluoride. The purpose for collection of TAL metals and Sulfate, Carbonate and Fluoride is to provide multiple lines of evidence to delineate and differentiate radiological constituents associated with LBSR disposed of at the site from radiological constituents associated with other solid waste and/or naturally occurring radionuclides.

Ra226. Uranium decay chain (significant daughter)

Ra228. Thorium decay chain (significant daughter)

Th230. Uranium decay chain (significant daughter)

Th232. Thorium decay chain (main parent)

U234. Uranium decay chain (parent and daughter of U238) (also found in nature)

U235. Actinium decay chain (main parent) (fissile, but also found in nature in very small concentrations)

U238. Uranium decay chain (main parent) (also found in nature, most abundant uranium isotope)

Ac227. Uranium decay chain (significant daughter)

K40, naturally occurring radionuclide with a half-life of 1.3B years, typically associated with organic material. It is NOT present in any of the three decay chains mentioned above.

Pa231. Actinium decay chain (significant daughter)

Scandium??? Not a natural decay chain radionuclide, actually seems more like a metal analysis than a radionuclide.

Pb210. Uranium decay chain (lessor daughter) (found below radon decay and can be associated with natural atmospheric rainout events) (22 yr half-life)

Uranium Chain: The only other significant decay daughter from a half-life perspective not listed is Po210 with a half-life of 138 days. And it's below Pb210 and right before stable Pb206. I see no reason to test for it.

Thorium chain: The only other significant decay daughter from a half-life perspective not listed is Th228 with a half-life of 1.9 years. It's above the Rn220 on this chain so really it should be in secular equilibrium with Ra228. It takes about 10x the half-life of the daughter to reach equilibrium with the parent. I see no reason to test for it.

Actinium chain: The next significant decay daughter from a half-life perspective not listed is Th227 with a half-life of 19 days. I see no reason to test for it.

So the only odd thing is this scandium test. Like I said, it doesn't seem to belong with the other radionuclides listed.

One last thought: If it's found that a different radioactive waste stream from uranium processing is identified in addition to, or even instead of, the leached barium sulfate, does that make any relevant difference to us? I would think it might have an effect on additional PRPs (maybe), but not on a remedy going forward. I would also think that any additional testing will be relatively

consistent with the Th230:Ra226:U238 concentration and ratio's that we've already seen.

(Sorry for this long and convoluted email that provided no real substantive changes to your highlight below.)

Surprisingly good resource on the natural decay chains:

http://en.wikipedia.org/wiki/Decay_chain

Chuck Hooper, CHP

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From: Vann, Bradley

Sent: Wednesday, May 20, 2015 6:39 AM

To: Hooper, Charles A.

Subject: RE: Recent CAG question

Chuck,

I also have one more question (sorry missed it yesterday). See if my answer is correct or needs revision:

EMSI: #6) Based on the results of the GCPT gamma logs...will be used to evaluate whether the radionuclide occurrences are associated with Leached Barium Sulfate Residue (LBSR).

CAG Question 4: The Atomic Energy Commission (AEC) explicitly details how the radioactive wastes dumped at the West Lake Landfill in 1973 consisted of more radioactive wastes than "Leached Barium Sulfate Residue" in its 1974 decommission report on Latty Avenue.

EPA Response: The analytical testing being performed at the West Lake Landfill site will detect radionuclides concentrations regardless of the CAG's concern for its origin.

Thanks,

Bradley Vann - Remedial Project Manager

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From: Vann, Bradley
Sent: Wednesday, May 20, 2015 6:17 AM
To: Hooper, Charles A.
Subject: RE: Recent CAG question

Chuck, great answer and I will respond with it. I don't understand where this question is coming from or why, unless you have some thoughts on it?

Thanks,

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From: Hooper, Charles A.
Sent: Tuesday, May 19, 2015 3:14 PM
To: Vann, Bradley

Subject: RE: Recent CAG question

Brad,

Ra223 and Th227 both have relatively short half-lives, 11 days & 18 days, so really you wouldn't expect them to be present in the landfill after all this time unless they are being fed from a parent radionuclide from higher up on the decay chain. In that case they would have the same activity as a parent radionuclide like Ac227 or Pa231.

And the 12 radionuclides that EMSI is testing for are include both Ac227 and Pa231:

Radium-226; Radium-228; Thorium-230 and Thorium-232; Uranium-234, Uranium-235 and Uranium-238; Actinium-227; Potassium-40; Protactinium-231; Scandium; and Lead-210.

So essentially you can make a mathematical assumption that the activity of Ra223 and Th227 would have the same activity as Ac227. I've tried to find out how a lab determines the Ac227 activity but I'm having trouble finding anything. But depending on how "easy" it is to count Ac227 and/or Pa231, they might actually be using the activity of the daughter radionuclides (like Ra223 and Th227) as a surrogate for the parent. Labs tend to do that kind of thing when they know a sample will be in secular equilibrium. If this doesn't answer your question then we could ask the contractor to find out exactly how the Ac227 value is being determined, and whether the Ra223 and Th227 would show up in the gamma spectrum.

-Chuck

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From: Vann, Bradley
Sent: Tuesday, May 19, 2015 11:39 AM
To: Hooper, Charles A.
Subject: Recent CAG question

Chuck,

We received a question from the CAG regarding the ongoing GCPT Phase 1D effort. Can you help me answer this one? Thanks,

EMSI: #7) Details 12 radioactive isotopes to be tested.

CAG: We recommend additional testing for Radium-223 and Thorium-227. If the EPA cannot amend the Phase 1 Investigation Work Plan to include sampling for the above mentioned radioisotopes, the CAG recommends that EPA Region 7 conduct tests for the listed isotopes in its split samples.

EPA Response: ???

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